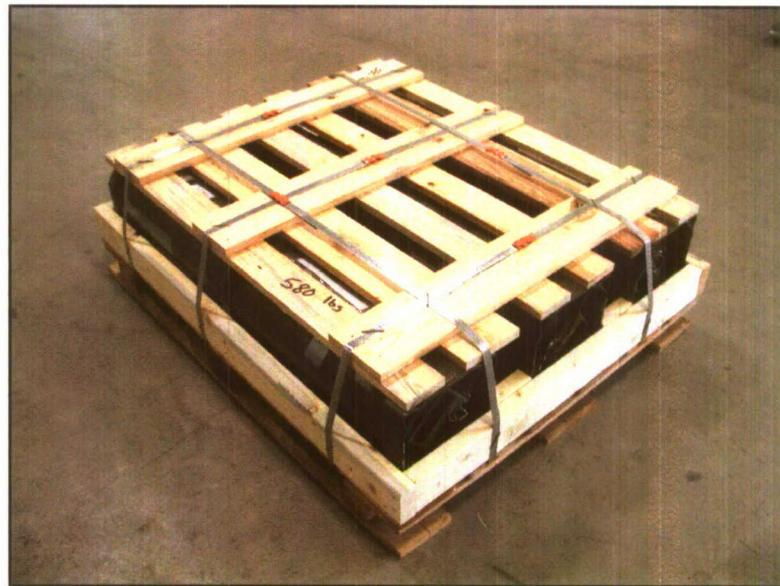


FINAL REPORT
December 2007

REPORT NO. 07-12



**PROJECTILE, 155MM, XM982, EXCALIBUR,
PACKED ONE (1) PER PA179 CONTAINER,
UNITIZED UP TO THREE (3) PER 40" x 48" WOODEN PALLET,
MIL-STD-1660 TESTS**

Distribution Unlimited

Prepared for:

Office of PM Excalibur
ATTN: System Engineer, Laura Wells
U.S. Army ARDEC, SFAE-AMO-CASS-EX, Bldg 171A
Picatinny, NJ 07806-5000



**DEFENSE AMMUNITION CENTER
VALIDATION ENGINEERING DIVISION
MCALISTER, OKLAHOMA 74501-9053**

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**PROJECTILE, 155MM, XM982, EXCALIBUR,
PACKED ONE (1) PER PA179 CONTAINER,
UNITIZED UP TO THREE (3) CONTAINERS
PER 40" x 48" WOODEN PALLET, MIL-STD-1660 TESTS**

ABSTRACT

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), conducted tests in accordance with MIL-STD-1660, "Design Criteria for Ammunition Unit Loads" on the XM982 155MM Excalibur Projectile packed one (1) per PA179 container, unitized up to three (3) containers per 40" x 48" wooden pallet designed by DAC, Transportation Engineering Division (SJMAC-DET). The testing was for the Office of Program Manager for Excalibur, U.S. Army ARDEC, Picatinny, NJ. Two (2) test units were each tested at a weight of 580 lbs and one (1) test unit was tested at 285 lbs. The tests accomplished were the Stacking, Repetitive Shock, Drop, Incline-Impact, Forklifting, and Disassembly tests.

Test Units #1 and #2 passed the MIL-STD-1660 requirements listed above with minimal damage incurred to the test units. Test Unit #3 was loaded using one PA179 container with two (2) wooden dunnage space fillers to represent a pallet with only one (1) round. Test Unit #3 passed the MIL-STD-1660 requirements listed above.

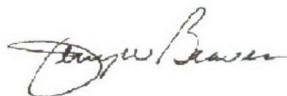
As a result of the performance during testing, the XM982 155MM Excalibur Projectile packed one (1) per PA179 container, unitized up to three (3) containers per 40" x 48" wooden pallet is acceptable for use by the U.S. Army.

Prepared by:



JEFFERY L. DUGAN
Validation Engineer

Reviewed by:



JERRY W. BEAVER
Chief, Validation Engineering Division

U.S. ARMY DEFENSE AMMUNITION CENTER

**VALIDATION ENGINEERING DIVISION
MCALISTER, OK 74501-9053**

REPORT NO. 07-12

**PROJECTILE, 155MM, XM982, EXCALIBUR,
PACKED ONE (1) PER PA179 CONTAINER,
UNITIZED UP TO THREE (3) CONTAINERS PER 40" x 48"
WOODEN PALLET, MIL-STD-1660 TESTS**

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PART 1 – INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAG-DEV), conducted tests in accordance with MIL-STD-1660, “Design Criteria for Ammunition Unit Loads” on the XM982 155MM Excalibur Projectile packed one (1) per PA179 container, unitized up to three (3) containers per 40” x 48” wooden pallet designed by DAC, Transportation Engineering Division (SJMAG-DET). The testing was for the Office of Program Manager for Excalibur, U.S. Army ARDEC, Picatinny, NJ. Two (2) test units were each tested at a weight of 580 lbs and one (1) test unit was tested at 285 lbs. The tests accomplished were the Stacking, Repetitive Shock, Drop, Incline-Impact, Forklifting, and Disassembly tests.

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Joint Munitions Command (JMC), Rock Island, IL. Reference is made to the following:

1. AR 740-1, 15 June 2001, Storage and Supply Activity Operation
2. OSC-R, 10-23, Mission and Major Functions of the U.S. Army Defense Ammunition Center (DAC) 21 Nov 2000.

C. OBJECTIVE. The objective of the tests was to determine if the XM982 155MM Excalibur Projectile packed one (1) per PA179 container, unitized up to three (3) containers per 40” x 48” wooden pallet met MIL-STD-1660 test requirements prior to the acceptance of the unitization procedures by the U.S. Army.

D. CONCLUSION. As a result of the performance during testing, the XM982 155MM Excalibur Projectile packed one (1) per PA179 Container, unitized up to three (3) containers per 40” x 48” wooden pallet is acceptable for use by the U.S. Army.

PART 2 - ATTENDEES

DATE PERFORMED:

Test Unit #1- 22 October 2007

Test Unit #2- 24 October 2007

Test Unit #3- 1 November 2007

ATTENDEES

Jeffery L. Dugan
General Engineer
DSN 956-8090
(918) 420-8090

Daryl Sieczkowski
Electronic Technician
DSN 956-8988
(918) 420-8988

MAILING ADDRESS

Director
U.S. Army Defense Ammunition Center
ATTN: SJMAC-DEV
1 C Tree Road, Bldg. 35
McAlester, OK 74501-9053

Director
U.S. Army Defense Ammunition Center
ATTN: SJMAC-DEV
1 C Tree Road, Bldg. 35
McAlester, OK 74501-9053

PART 3 - TEST PROCEDURES

The test procedures outlined in this section were extracted from the MIL-STD-1660. The tests are conducted on ammunition pallet units or unit loads and are summarized as follows:

A. STACKING TEST. The test unit will be tested to simulate a stack of a full pallet load of 4,000 lbs, for a period of one (1) hour. This stacking load will be simulated by subjecting the specimen to a compression weight equal to one (1) full pallet load. Photo 1 below shows an example of a unit load in the compression tester.



Photo 1. Example of Stacking Test.
(2.75-inch Hydra 70, PA151 Rocket Pallet in the Stacking Test.)

B. REPETITIVE SHOCK TEST. The repetitive shock test is conducted IAW Method 5019, Federal Standard 101. The test procedure is as follows: The test unit will be placed on (not fastened to) the platform. With the test unit in one position, the platform will be vibrated at $\frac{1}{2}$ -inch amplitude (1-inch double amplitude) starting at a frequency of approximately 3 cycles-per-second. The

frequency will be steadily increased until the specimen leaves the platform. The resonant frequency is achieved when a 1/16-inch-thick feeler gage momentarily slides freely between every point on the specimen in contact with the platform at some instance during the cycle. Midway into the testing period, the specimen will be rotated 90 degrees, and the test continued for the duration. Unless failure occurs, the total time of vibration will be three hours. Photo 2 shows an example of the repetitive shock test.



**Photo 2. Example of the Repetitive Shock Test.
(MSTF Low)**

C. EDGEWISE-ROTATIONAL DROP TEST. This test is conducted using the procedures of Method 5008, Federal Standard 101. The procedure for the edgewise rotational drop test is as follows: The test unit will be placed on its skids with one end of the pallet supported on a beam 6 inches high. The height of the beam will be increased as necessary to ensure that there is no support for the skids between the ends of the specimen when the dropping takes place, but should not be high enough to cause the specimen to slide on the supports when the dropped end is raised for the drop. The unsupported end of the specimen is then raised and allowed to fall freely to the concrete, pavement, or similar unyielding surface from a prescribed height. Unless otherwise specified, the height of drop for level A protection will conform to the following tabulation:

GROSS WEIGHT (WITHIN RANGE LIMITS) (Pounds)	DIMENSIONS OF ANY EDGE, HEIGHT OR WIDTH (WITHIN RANGE LIMITS) (Inches)	HEIGHT OF DROPS ON EDGES	
		Level A (Inches)	Level B (Inches)
150-250	60-66	36	27
250-400	66-72	32	24
400-600	72-80	28	21
600-1,000	80-95	24	18
1,000-1,500	95-114	20	16
1,500-2,000	114-144	17	14
2,000-3,000	Above 145- No limited	15	12
Above – 3,000		12	9

Figure 1.



Photo 3. Example of Edgewise Rotational Drop Test
(MSTF Low)

D. **INCLINE-IMPACT TEST.** This test is conducted by using the procedure of Method 5023, Incline-Impact Test of Federal Standard 101. The procedure for the incline-impact test is as follows: The test unit will be placed on the carriage with the surface or edge to be impacted projecting at least 2 inches beyond the

front end of the carriage. The carriage will be brought to a predetermined position on the incline and released. If it were desired to concentrate the impact on any particular position on the container, a 4- x 4-inch timber may be attached to the bumper in the desired position before the test. The carriage will not strike any part of the timber. The position of the specimen on the carriage and the sequence in which surfaces and edges are subjected to impacts may be at the option of the testing activity and dependent upon the objective of the test. When the test is to determine satisfactory requirements for a container or pack, and, unless otherwise specified, the specimen will be subjected to one impact on each surface that has each dimension less than 9.5 feet. Unless otherwise specified, the velocity at the time of the impact will be 7 feet-per-second. Photo 4 shows an example of this test.



**Photo 4. Example of the Incline-Impact Test.
(2.75-Inch, Hydra 70, PA151 Rocket Pallet on incline-impact tester.)**

E. SLING COMPATIBILITY TEST. The test unit utilizing special design or non-standard pallets will be lifted, swung, lowered and otherwise handled as necessary, using slings of the types normally used for handling the unit loads

under consideration. Slings will be easily attached and removed. Danger of slippage or disengagement when load is suspended will be cause for rejection of the specimen.

F. FORKLIFTING TESTS. The test unit will be lifted clear of the ground by a forklift from the end of the test unit and transported on the forks in the level or back-tilt position. The forklift will pass over the Optional Rough Handling Course for Forklift Trucks as outlined in MIL-STD-1660. The course will consist of parallel pairs of 1-inch boards spaced 54 inches apart and will be laid flat wise on the pavement across the path of the forklift. One pair will be laid at an angle of approximately 60 degrees to the path so that the left wheel strikes first. Another pair will be laid securely across the path of the forklift so that the wheels strike simultaneously. Another pair will be laid at an angle of approximately 75 degrees to the path so that the right wheel strikes first. The test unit will be transported over the Optional Rough Handling Course. The test unit shall be observed for deflection and damage. The test unit will be rotated 90 degrees and the test unit lifted from the side and the above steps repeated.

G. DISASSEMBLY TEST. Following all rough handling tests the test unit may be squared up within 2 inches of its original shape and on a flat level surface. The strapping will then be cut and removed from the palletized load. Assembly of the test unit will be such that it retains its unity upon removal of the strapping.

PART 4 - TEST EQUIPMENT

A. COMPRESSION TESTER.

1. Nomenclature	Compression Table
2. Manufacturer:	Ormond Manufacturing
3. Platform:	60- by 60-inches
4. Compression Limit:	50,000 pounds
5. Tension Limit:	50,000 pounds

B. TRANSPORTATION (REPETITIVE SHOCK) SIMULATOR.

1. Nomenclature	Repetitive Shock Simulator
2. Manufacturer:	Gaynes Laboratory
3. Capacity:	6,000-pound payload
4. Displacement:	1/2-inch amplitude
5. Speed:	50 to 400 RPM
6. Platform:	5- by 8-foot

C. INCLINED PLANE.

1. Manufacturer:	Conbur Incline
2. Type:	Impact Tester
3. Grade:	10 percent incline
4. Length:	12-foot

PART 5 - TEST RESULTS

A. CONTAINER DATA. The test units were inertly loaded to the specified design weight. Special care was taken to ensure that each individual interior ammunition container had the proper amount of weight in order to achieve a realistic pallet center of gravity (CG). Once properly prepared, the test unit was tested using MIL-STD-1660, "Design Criteria for Ammunition Unit Loads," requirements. Photo 5 shows the configuration of Test Units #1 and #2.

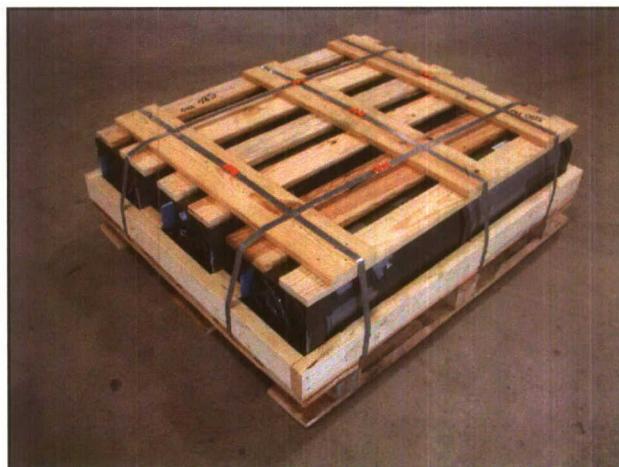


Photo 5. Configuration of Test Units #1 and #2.

TEST UNIT #1:

Test Date:	22 October 2007	<u>Container inertly loaded with:</u>
Weight:	580 pounds	3 PA171 Containers
Length:	48 inches	loaded to 156 pounds each with
Width:	40 inches	inert material
Height:	16-1/4 inches	

TEST UNIT #2:

Test Date:	24 October 2007	<u>Container inertly loaded with:</u>
Weight:	580 pounds	3 PA171 Containers
Length:	48 inches	loaded to 156 pounds each with
Width:	40 inches	inert material
Height:	16-1/4 inches	



Photo 6. Configuration of Test Unit #3.

TEST UNIT #3:

Test Date:	1 November 2007	<u>Container inertly loaded with:</u>
Weight:	285 pounds	1 PA171 Container
Length:	48 inches	loaded to 156 pounds with
Width:	40 inches	inert material
Height:	16-1/4 inches	

B. TEST RESULTS OF TEST UNIT #1 DURING MIL-STD-1660 TESTING:

1. STACKING TEST. Test Unit #1 was compressed with a load force of 4,000 pounds for 60 minutes on 22 October 2007. There was no damage noted to the test unit as a result of this test. See Photo 7 below for a typical picture of the test unit in the compression tester.



Photo 7. Test Setup for Stacking Testing.

2. REPETITIVE SHOCK TEST. Test Unit #1 was vibrated 90 minutes at 210 RPM in the longitudinal orientation and 90 minutes at 225 RPM in the lateral orientation on 22 October 2007. No significant damage was noted during this test. See Photo 8 below for a typical picture of the test unit during Repetitive Shock tests.



Photo 8. Test Setup for Repetitive Shock Testing.

3. **EDGEWISE-ROTATIONAL DROP TEST.** Test Unit #1 was edgewise-rotationally dropped from a height of 28 inches on the longitudinal and lateral sides. No damage was noted during this test. See Photo 9 for the test setup for the Drop tests.



Photo 9. Test Setup for Drop Testing.

4. **FORKLIFTING TEST.** Test Unit #1 was lifted from the end of the pallet on the forks of the forklift truck and carried over the hazard course three times with no damage or instability noted. The test unit was lifted from the adjacent

side of the pallet and the above steps accomplished with no problems encountered. See Photo 10 for the test setup during the Forklifting test.



Photo 10. Test Setup for Forklifting Testing.

5. **DISASSEMBLY TEST**. During the disassembly of Test Unit #1 no additional problems were noted.
6. **CONCLUSION**. Test Unit #1 passed all required tests of MIL-STD-1660.

C. TEST RESULTS OF TEST UNIT #2 DURING MIL-STD-1660 TESTING:

1. **STACKING TEST**. Test Unit #2 was compressed with a load force of **4,000** pounds for 60 minutes on 24 October 2007. There was no damage noted to the test unit as a result of this test.
2. **REPETITIVE SHOCK TEST**. Test Unit #2 was vibrated 90 minutes at **210** RPM in the longitudinal orientation and 90 minutes at **225** RPM in the lateral orientation on 24 October 2007. No significant damage was noted during this test.

3. **EDGEWISE-ROTATIONAL DROP TEST**. Test Unit #2 was edgewise-rotationally dropped from a height of 28 inches on the longitudinal and lateral sides. No damage was noted during this test.

4. **FORKLIFTING TEST**. Test Unit #2 was lifted from the end of the pallet on the forks of the forklift truck and carried over the hazard course three times with no damage or instability noted. The test unit was lifted from the adjacent side of the pallet and the above steps accomplished with no problems encountered.

5. **DISASSEMBLY TEST**. During the disassembly of Test Unit #2 no additional problems were noted.

6. **CONCLUSION**. Test Unit #2 passed all required tests of MIL-STD-1660.

D. TEST RESULTS OF TEST UNIT #3 DURING MIL-STD-1660 TESTING:

1. **STACKING TEST**. Test Unit #3 was compressed with a load force of 4,000 pounds for 60 minutes on 1 November 2007. There was no damage noted to the test unit as a result of this test.

2. **REPETITIVE SHOCK TEST**. Test Unit #3 was vibrated 90 minutes at 210 RPM in the longitudinal orientation and 90 minutes at 225 RPM in the lateral orientation on 1 November 2007. No significant damage was noted during this test.

3. **EDGEWISE-ROTATIONAL DROP TEST**. Test Unit #3 was edgewise-rotationally dropped from a height of 28 inches on the longitudinal and lateral sides. No damage was noted during this test.

4. **FORKLIFTING TEST**. Test Unit #3 was lifted from the end of the pallet on the forks of the forklift truck and carried over the Hazard Course three times with no damage or instability noted. The test unit was lifted from the adjacent side of the pallet and the above steps accomplished with no problems encountered.

5. **DISASSEMBLY TEST**. During the disassembly of Test Unit #3 no additional problems were noted.

6. **CONCLUSION**. Test Unit #3 passed all required tests of MIL-STD-1660.

PART 6– DRAWINGS

The following test sketches represent the load configuration that was subjected to the test criteria.

DET 0801

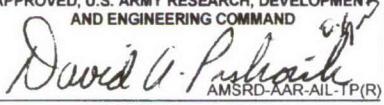
UNITIZATION PROCEDURES FOR FIELD RETURNS OF COMPLETE ROUNDS IN CYLINDRICAL METAL CONTAINERS ON 4-WAY ENTRY PALLETS

**PROJECTILE, 155MM, XM982, EXCALIBUR, PACKED
1 PER PA179 CONTAINER, UNITIZED UP TO 3 CON-
TAINERS PER 40" X 48" WOODEN PALLET; APPROX
CONTAINER SIZE 44-1/2" L X 9-1/4" W X 9-1/4" H**

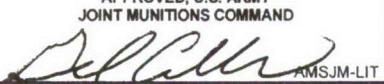
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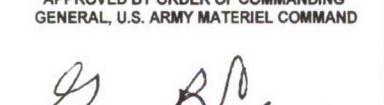
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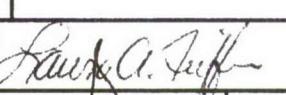
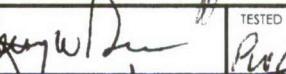
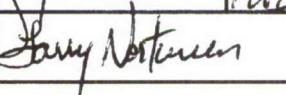
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SPECIAL DRAWING

DET 0801

GENERAL NOTES

A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1 AND AUGMENTS TM 743-200-1 (CHAPTER 5) AND CONFORMS TO MIL-STD-1660.

B. THE UNITIZATION PROCEDURES SPECIFIED IN THIS DRAWING ARE APPLICABLE TO FIELD RETURNS OF THREE OR LESS EXCALIBUR PROJECTILES PACKED IN PA179 CONTAINERS. **NOTE:** IF MORE THAN THREE CONTAINERS ARE TO BE RETURNED, PROCEDURES DEPICTED IN AMC DRAWING 19-48-4231/55-20PM1006 SHALL BE FOLLOWED. SEE ARDEC DRAWING 13001473 FOR DETAILS OF THE PA179 CONTAINER.

C. ANY REQUEST FOR DEVIATION FROM THE PROCEDURES DELINATED HEREIN MUST BE DIRECTED TO THE COMMANDER, U.S. ARMY RDECOM-ARDEC, ATTN: AMSRD-AAR-AIL-TP (R), ROCK ISLAND, IL 61299-7300, FOR SPECIFIC APPROVAL. FOR EXAMPLE, SPECIFIC APPROVAL MUST BE OBTAINED FOR UNITIZATION OF AN ITEM WHEN PACKED IN CONTAINERS WHICH ARE DIFFERENT IN SIZE THAN THOSE SHOWN IN THE DRAWING FOR THAT ITEM. CONFIGURATION MANAGEMENT PROCEDURES CONTAINED IN MIL-STD-973 DO NOT APPLY TO THIS DRAWING OR ANY APPENDICES THERETO.

D. A PLUS-OR-MINUS 1/4" IS ALLOWED ON OVERALL DIMENSIONS OF A FILLER ASSEMBLY, SPACER ASSEMBLY OR ANY OTHER DUNNAGE ASSEMBLY. HOWEVER, SIMILAR PIECES IN AN ASSEMBLY MUST BE WITHIN 1/8" OF THE SAME DIMENSION.

E. DIMENSIONAL LUMBER SPECIFIED THROUGHOUT THIS PROCEDURAL DRAWING IS OF NOMINAL SIZE UNLESS OTHERWISE SPECIFIED. FOR EXAMPLE, 1" X 4" MATERIAL IS ACTUALLY 3/4" THICK BY 3-1/2" WIDE AND 2" X 4" MATERIAL IS ACTUALLY 1-1/2" THICK BY 3-1/2" WIDE.

F. IN ORDER TO OBTAIN COMPACT (SOUND) UNITS, ALL STRAPS SHALL BE LOCATED IN PROPER ALIGNMENT AND TENSIONED UNTIL THEY CUT INTO THE EDGE OF THE TOP ASSEMBLY AND/OR THE PALLET DECK. AFTER TENSIONING, EACH STRAP WILL BE SECURED USING ONE SEAL AND TWO PAIR OF NOTCHES PER SEAL.

G. WHEN APPLYING ANY STRAP, CARE MUST BE EXERCISED TO ASSURE THAT THE END OF THE STRAP ON THE UNDERSIDE OF THE JOINT EXTENDS AT LEAST 6" BEYOND THE SEAL. THIS EXTRA MINIMUM LENGTH OF THE STRAP IS REQUIRED TO PERMIT SUBSEQUENT TIGHTENING OF LOOSENED STRAPPING. RETENSIONING CAN BE ACCOMPLISHED WITHOUT REPLACING STRAPPING OR SPLICING STRAPPING THROUGH THE USE OF A MANUAL OR PNEUMATIC FEED-WHEEL TYPE TENSIONING TOOL AND THE APPLICATION OF ONE ADDITIONAL SEAL.

(CONTINUED AT RIGHT)

MATERIAL SPECIFICATIONS

PALLET - - - - -: MIL SPEC MIL-P-15011; 4-WAY ENTRY, STYLE 1, TYPE I, CLASS 1, PRESERVATIVE AND HEAT TREATED. SEE GENERAL NOTE "R" ON PAGE 3.

LUMBER - - - - -: SEE TM 743-200-1 (DUNNAGE LUMBER) AND VOLUNTARY PRODUCT STANDARD PS 20 FOR FILLER ASSEMBLIES. ASTM D6199; CLASS 2, GROUP II, III, OR IV, PRESERVATIVE AND HEAT TREATED FOR OTHER DUNNAGE ASSEMBLIES. **NOTE:** ONLY GROUP IV LUMBER IN ACCORDANCE WITH ASTM D6199 WILL BE ACCEPTABLE FOR THE CONSTRUCTION OF THE PALLET. SEE GENERAL NOTES "O" AT RIGHT AND "R" ON PAGE 3.

NAILS - - - - -: ASTM F1667; COMMON STEEL NAIL (NLCMS), ALT: UNDERLAYMENT NAIL (NLUL), PALLET NAIL (NLPL), OR COOLER NAIL (NLCL) OF SAME SIZE. SEE GENERAL NOTE "Q" ON PAGE 3.

PLYWOOD - - - - -: COMMERCIAL ITEM DESCRIPTION A-A-55057, INDUSTRIAL PLYWOOD, INTERIOR WITH EXTERIOR GLUE, GRADE C-D. IF SPECIFIED GRADE IS NOT AVAILABLE, A BETTER INTERIOR OR AN EXTERIOR GRADE MAY BE SUBSTITUTED.

STRAPPING, STEEL - - -: ASTM D3953; FLAT STRAPPING, TYPE 1, HEAVY DUTY, FINISH B (GRADE 2), SIZE 3/4" X .035" OR .031". ALTERNATIVE SIZE 1-1/4" X .035" OR .031". **NOTE:** IF EDGES DO NOT MEET THE PREECE TEST FOR GRADE 2, ANY BRUTE OR SLIT EDGES SHALL HAVE FINISH A OVERLAY APPLIED.

SEAL, STRAP - - -: ASTM D3953; CLASS H, FINISH B (GRADE 2), DOUBLE NOTCH TYPE, STYLE I, II, III, OR IV. ALTERNATIVE SEAL FINISH: SIGNODE OR DELTA PAINTED SEALS MAY BE USED AS AN ALTERNATIVE IF ALL SURFACES ARE PAINTED. GRITTED BACKING IS NOT PERMITTED.

STAPLE, STRAP - - -: ASTM F1667; STFCS-189, STFCS-198, STFCS-207, OR STFCS-216, 15/16" OR 1" CROWN WIDTH X 3/4" LEG LENGTH FOR 3/4" STRAPPING OR STFCS-224, 1-17/32" CROWN WIDTH X 3/4" LEG LENGTH FOR 1-1/4" STRAPPING.

(GENERAL NOTES CONTINUED)

H. PALLET UNIT LOADS SHALL BE INSPECTED FOR TORN, DETERIORATED OR LOOSENED STRAPPING PRIOR TO SHIPPING.

1. TORN OR BROKEN STRAPS SHOULD BE REPLACED BY CONTRACTORS, BUT MAY BE REPAIRED AT THE DEPOT/FIELD LEVEL BY SPLICING IN A MANNER SIMILAR TO THAT DESCRIBED IN "H.4(B)" BELOW.

2. DETERIORATION DUE TO A MINOR AMOUNT OF RUST WILL NOT NECESSARILY BE CAUSE FOR REPLACING A STRAP. HOWEVER, AN EXTENSIVELY RUSTED/SCALED/PITTED STRAP IS CAUSE FOR REPLACING THE STRAP.

3. A DAMAGED OR DEFECTIVE SEAL IS SUFFICIENT CAUSE FOR REPLACEMENT OF THE SEAL.

4. LOOSE STRAPS SHOULD BE CHECKED FOR DEGREE OF LOOSENESS BY POSITIONING THE HOOK OF A SCALE (COMMONLY KNOWN AS A FISH SCALE) BEHIND THE STRAPS NEAR THE MIDPOINT AT THE TOP OR SIDE OF THE UNIT LOAD. PULL THE SCALE UNTIL A READING OF 20 POUNDS IS OBTAINED. THE DISTANCE BETWEEN THE INITIAL POSITION OF THE STRAP AND THE STRAP UNDER THE 20 POUND LOAD MUST NOT EXCEED 1". IF MEASUREMENT EXCEEDS 1", THE STRAP MUST BE TIGHTENED OR REPLACED. TIGHTENING CAN BE ACCOMPLISHED BY EITHER OF TWO METHODS.

(A) A STRAP TENSIONING TOOL CAN BE USED IF THE STRAP HAS AT LEAST A 6" LONG TAB AT THE SEAL. SEE GENERAL NOTE "G" AT LEFT.

(B) AN 18" OR LONGER STRAP CAN BE USED AS A SPLICE PIECE. CUT THE LOOSE STRAP ON BOTH SIDES OF THE ORIGINAL SEAL AND DISCARD THE CUT OUT SECTION. OVERLAP ONE END OF THE STRAP SPLICE PIECE TO ONE END OF THE ORIGINAL STRAPPING SO AS TO PROTRUDE SLIGHTLY BEYOND THE END OF THE SEAL TO BE USED. POSITION AND SECURE SEAL TO OVERLAPPED SECTION WITH TWO PAIR OF NOTCHES. USING A STRAPPING TOOL, TENSION AND SEAL THE LENGTHENED STRAP. THE STRAP SPLICE PIECE MAY BE CUT FROM NEW STRAP OR USED STRAP, PROVIDED IT IS AT LEAST AS GOOD A QUALITY AS THE STRAP TO WHICH IT IS BEING SECURED. **NOTE:** ONLY ONE SPLICE PER STRAP IS ALLOWED ON UNIT LOADS OF AMMUNITION.

5. **CAUTION:** WHEN A STRAP IS REPLACED/SPLICED OR RETENSIONED, AND THE OTHER STRAPS ON A UNIT LOAD ARE NOT, CARE MUST BE EXERCISED TO INSURE THAT THE TENSION ON THE AFFECTIONATE STRAP IS NEARLY THE SAME AS THAT OF THE OTHER STRAPS.

J. ROOFING NAILS IN ACCORDANCE WITH ASTM F1667 NL RF R-02Z MAY BE USED AS AN ALTERNATE TO STAPLES FOR SECURING STEEL STRAPS TO BOARDS. NAILS MUST BE APPLIED NEXT TO THE STRAPPING SUCH THAT THE NAIL HEADS OVERLAP THE STRAPPING. APPLY TWO NAILS IN PAIRS (TO REPLACE ONE STAPLE) ON EITHER SIDE OF THE STRAP, WITH THE SECOND NAIL APPLIED APPROXIMATELY 180 DEGREES FROM THE FIRST NAIL.

K. UNIT LOAD MARKING WILL BE ACCOMPLISHED IN ACCORDANCE WITH DAC DRAWING ACV00561, UNIT LOAD MARKING FOR SHIPMENT AND STORAGE, AMMUNITION AND EXPLOSIVES.

L. CONVERSION TO METRIC EQUIVALENTS: DIMENSIONS WITHIN THIS DOCUMENT ARE EXPRESSED IN INCHES, AND WEIGHTS ARE EXPRESSED IN POUNDS. WHEN NECESSARY, THE METRIC EQUIVALENTS MAY BE COMPUTED ON THE BASIS OF ONE INCH EQUALS 25.4MM AND ONE POUND EQUALS 0.454 KG.

M. WHEN ASSEMBLING A PALLET UNIT, CARE SHALL BE TAKEN TO INSURE THAT THE CONTAINERS AND DUNNAGE ASSEMBLIES ARE EVENLY ALIGNED SO THAT THE SIDES AND ENDS OF THE PALLET UNIT DO NOT EXCEED A 1/2" TOLERANCE, RELATIVE TO THE PALLET.

N. DIMENSIONS GIVEN FOR DUNNAGE ASSEMBLIES WILL BE FIELD CHECKED PRIOR TO THEIR ASSEMBLY. THIS GUIDANCE MUST BE APPLIED PRIOR TO BEGINNING A PALLETIZING OPERATION. ALSO, DUE TO VARIATIONS OF CONTAINER DIMENSIONS, ADJUSTMENTS MAY BE REQUIRED AS TO THE LOCATION OF CERTAIN PIECES ON DUNNAGE ASSEMBLIES.

O. ALL WOODEN DUNNAGE USED IN UNIT LOADS SHALL BE PRESERVATIVE TREATED IN ACCORDANCE WITH THE PROCEDURES SPECIFIED IN MIL-B-2427 FOR CLEATED WOODEN BOXES. IF THE DUNNAGE CONSISTS OF MORE THAN ONE COMPONENT, IT MUST BE ASSEMBLED PRIOR TO TREATMENT. THE LETTERS PA DENOTING PQ56 (COPPER-8-QUINOLINOLATE), PB DENOTING M-GARD W550 (ZINC NAPHTHENATE EMULSIFIABLE), OR PC DENOTING M-GARD W510 OR CUNAPSOL 5 (COPPER NAPHTHENATE) MUST BE APPLIED TO THE DUNNAGE IN LETTERS AT LEAST ONE INCH HIGH.

P. WHERE 3/4" WIDE STEEL STRAPPING IS SPECIFIED FOR USE BY THIS DRAWING, 1-1/4" WIDE STEEL STRAPPING MAY BE SUBSTITUTED FOR THE 3/4" STRAPPING, PROVIDED THAT THE BASIC REQUIREMENTS ARE SATISFIED. ALL OF THE SPECIFICATION CRITERIA SET FORTH UNDER THE "MATERIAL SPECIFICATIONS" FOR THE 3/4" STRAPPING AND STRAP SEALS WILL BE USED FOR THE 1-1/4" STRAPPING AND SEALS, EXCEPT FOR THE SIZE CRITERION.

Q. COOLER NAILS MAY BE SUBSTITUTED FOR THE COMMON NAILS AS SPECIFIED WITHIN EACH APPENDIX BY APPLYING THE FOLLOWING GUIDANCE. THE NUMBER OF COOLER NAILS TO BE USED WILL BE THE NUMBER OF COMMON NAILS MULTIPLIED BY 1.2 AND ROUNDED UP TO THE NEXT WHOLE NUMBER. THE SIZE OF THE COOLER NAILS TO BE USED WILL BE THE SAME AS SPECIFIED FOR THE COMMON NAILS (4d, 6d, 10d, ETC.) BUT WILL CONFORM TO THE SIZE AND WEIGHT TOLERANCES SPECIFIED WITHIN ASTM F1667 FOR COOLER NAILS.

(CONTINUED ON PAGE 3)

PALLET UNIT DATA				
ITEMS INCLUDED		*HAZARD CLASS AND DIVISION	*COMPATIBILITY GROUP	APPROX WEIGHT (LBS)
NSN	DODIC			
1320- 01-534-2535 01-552-1850	DA39 DA45	1.1 1.1	D D	593 593

*HAZARD AND CLASSIFICATION DATA CONTAINED IN THE ABOVE CHART IS FOR GUIDANCE AND INFORMATIONAL PURPOSES ONLY. VERIFICATION OF THE SPECIFIED DATA SHOULD BE MADE BY CONSULTING THE MOST RECENT JOINT HAZARD CLASSIFICATION SYSTEM LISTING OR OTHER APPROVED LISTING(S).

(GENERAL NOTES CONTINUED FROM PAGE 2)

R. ALL NON-MANUFACTURED WOOD USED IN THE PALLETIZED LOAD SHALL BE HEAT TREATED TO A CORE TEMPERATURE OF 56 DEGREES CELSIUS FOR A MINIMUM OF 30 MINUTES. THE PALLET MANUFACTURER AND THE MANUFACTURER OF WOOD TO BUILD FILLER ASSEMBLIES AND DUNNAGE ASSEMBLIES FOR THE PALLETIZED LOAD SHALL BE AFFILIATED WITH AN INSPECTION AGENCY ACCREDITED BY THE AMERICAN LUMBER STANDARDS COMMITTEE. THE PALLET MANUFACTURER AND THE MANUFACTURER OF WOOD USED TO BUILD FILLER ASSEMBLIES AND DUNNAGE ASSEMBLIES FOR THE PALLETIZED LOAD SHALL ENSURE TRACEABILITY TO THE ORIGINAL SOURCE OF HEAT TREATMENT. EACH PALLET, FILLER ASSEMBLY, OR DUNNAGE ASSEMBLY SHALL BE MARKED TO SHOW THE CONFORMANCE TO THE INTERNATIONAL PLANT PROTECTION CONVENTION STANDARD. PALLETS, FILLER ASSEMBLIES, AND DUNNAGE ASSEMBLIES MADE OF NON-MANUFACTURED WOOD SHALL BE HEAT TREATED AND MARKED APPROPRIATELY. THE QUALITY MARK FOR THE PALLET SHALL BE PLACED ON TWO OPPOSITE END POSTS. THE QUALITY MARK FOR THE FILLER ASSEMBLIES AND DUNNAGE ASSEMBLIES SHALL BE PLACED ON TWO OPPOSITE SIDES. FOREIGN MANUFACTURERS SHALL HAVE THE HEAT TREATMENT OF NON-MANUFACTURED WOOD PRODUCTS VERIFIED IN ACCORDANCE WITH THEIR NATIONAL PLANT PROTECTION ORGANIZATION'S COMPLIANCE PROGRAM.

S. DIMENSIONS, CUBE AND WEIGHT OF A PALLET UNIT WILL VARY SLIGHTLY DEPENDING UPON THE ACTUAL DIMENSIONS OF THE CONTAINERS AND THE WEIGHT OF THE SPECIFIC ITEM BEING UNITIZED.

T. THE LOAD STRAPS MUST BE THREADED THROUGH THE STRAP SLOTS OF A PALLET. LOAD STRAPS MUST BE TENSIONED AND SEALED PRIOR TO APPLICATION OF TIEDOWN STRAPS.

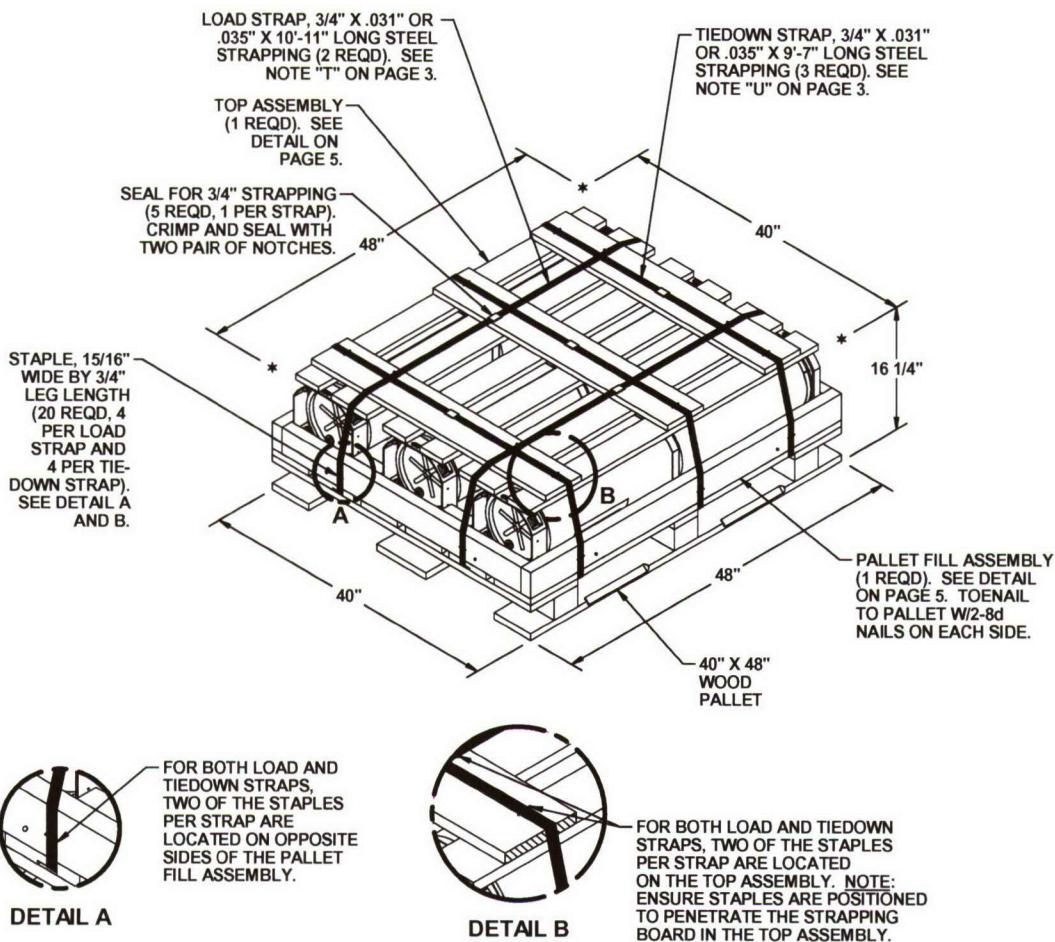
U. INSTALL EACH TIEDOWN STRAP TO PASS UNDER THE TOP DECK BOARDS OF THE PALLET AND TO BE LOCATED AS SHOWN. TIEDOWN STRAPS WILL NOT BE APPLIED UNTIL THE LOAD STRAPS HAVE BEEN TENSIONED AND SEALED.

V. THE FOLLOWING AMC DRAWINGS ARE APPLICABLE FOR OUTLOADING OF THE ITEMS COVERED BY THIS DRAWING. CAUTION: THIS PALLET UNIT IS NOT APPROVED FOR STORAGE, AND IS INTENDED FOR FIELD RETURNS ONLY.

CARLOADING - - - 19-48-4115-5PA1002
 TRUCKLOADING - - - 19-48-4117-11PA1003
 END OPENING ISO
 CONTAINER - - - 19-48-4153-15PA1002
 MILVAN - - - 19-48-4166-15PA1003
 SIDE OPENING ISO
 CONTAINER - - - 19-48-4267-15PA1009

W. THE STYLE 1 PALLET DELINEATED IN THE DETAIL ON PAGE 4 NEED NOT HAVE CHAMFERS AS SPECIFIED WITHIN MILITARY SPECIFICATION MIL-P-15011 WHEN USED FOR THE UNITIZATION OF ITEMS COVERED BY THIS DRAWING.

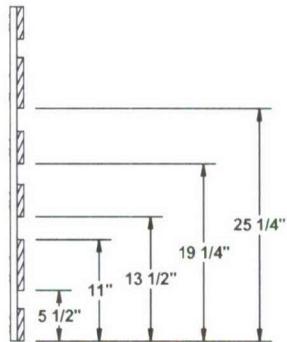
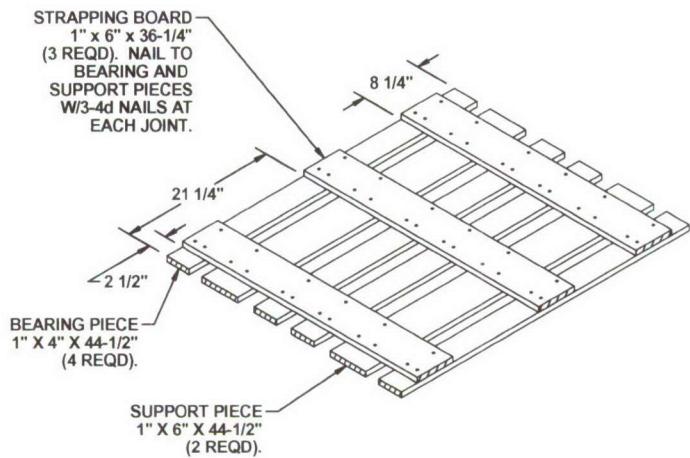
X. IF TWO OR LESS PA179 CONTAINERS ARE TO BE UNITIZED, FILLER ASSEMBLIES MUST BE USED. IF TWO PA179 CONTAINERS ARE TO BE UNITIZED, ONE FILLER ASSEMBLY WILL BE USED IN THE POSITION OF THE CENTER CONTAINER AS DETAILED IN "ONE FILLER ASSEMBLY UNIT LOAD" DETAIL ON PAGE 6. IF ONLY ONE PA179 CONTAINER IS TO BE UNITIZED, TWO FILLER ASSEMBLIES WILL BE USED AND POSITIONED WHERE THE TWO OUTER CONTAINERS NORMALLY WOULD APPEAR AS DEPICTED IN THE "TWO FILLER ASSEMBLY UNIT LOAD" DETAIL ON PAGE 6.



PALLET UNIT SEE GENERAL NOTE "S" ON PAGE 3.

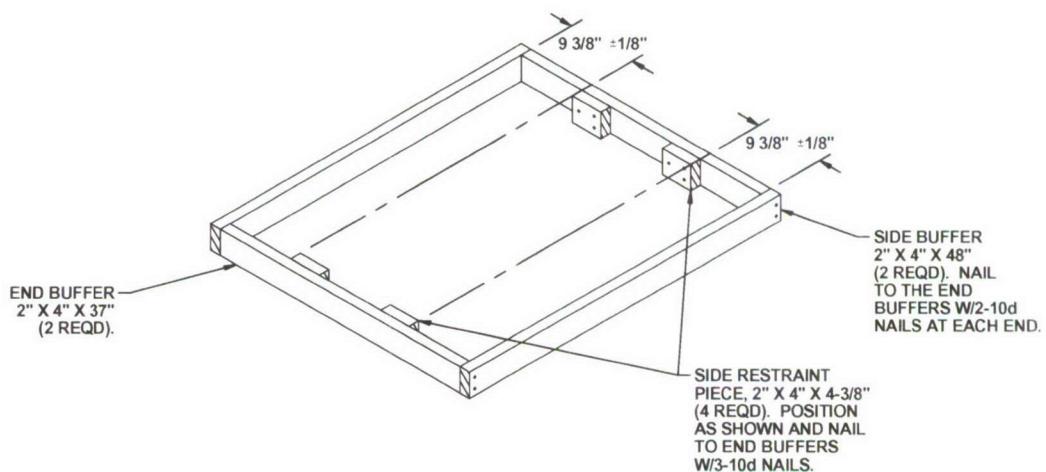
3 CONTAINERS OF PROJECTILES (1 PER CNTR) @ 156 LBS	468 LBS
DUNNAGE	55 LBS
PALLET	80 LBS
<hr/>	
TOTAL WEIGHT	603 LBS (APPROX)
CUBE	18.1 CU FT (APPROX)

BILL OF MATERIAL		
LUMBER	LINEAR FEET	BOARD FEET
1" X 4"	15	5
1" X 6"	17	9
2" X 4"	16	11
NAILS	NO. REQD	POUNDS
4d (1-1/2")	54	0.19
8d (2-1/2")	8	0.08
10d (3")	20	0.31
PALLET, 40" X 48"	1 REQD	80 LBS
STEEL STRAPPING, 3/4"	50.59' REQD	4.52 LBS
SEAL FOR 3/4" STRAPPING	5 REQD	NIL
STAPLE, 15/16" X 3/4"	20 REQD	NIL

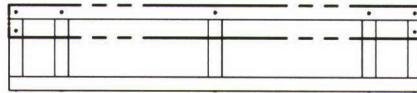
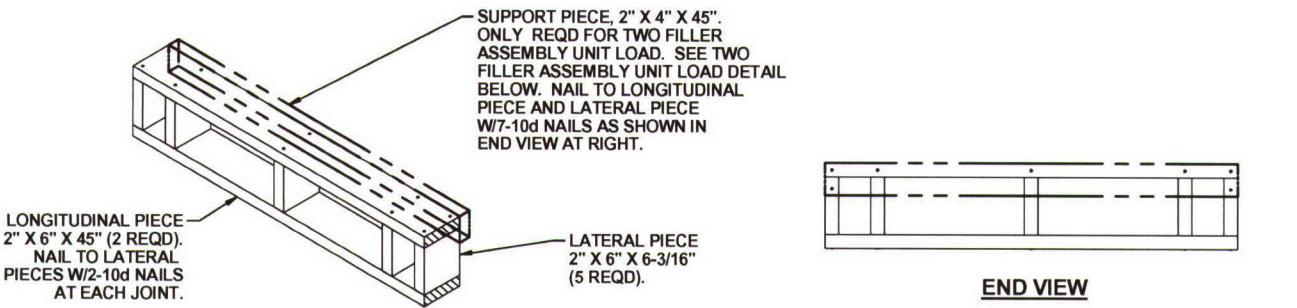


SIDE VIEW

TOP ASSEMBLY

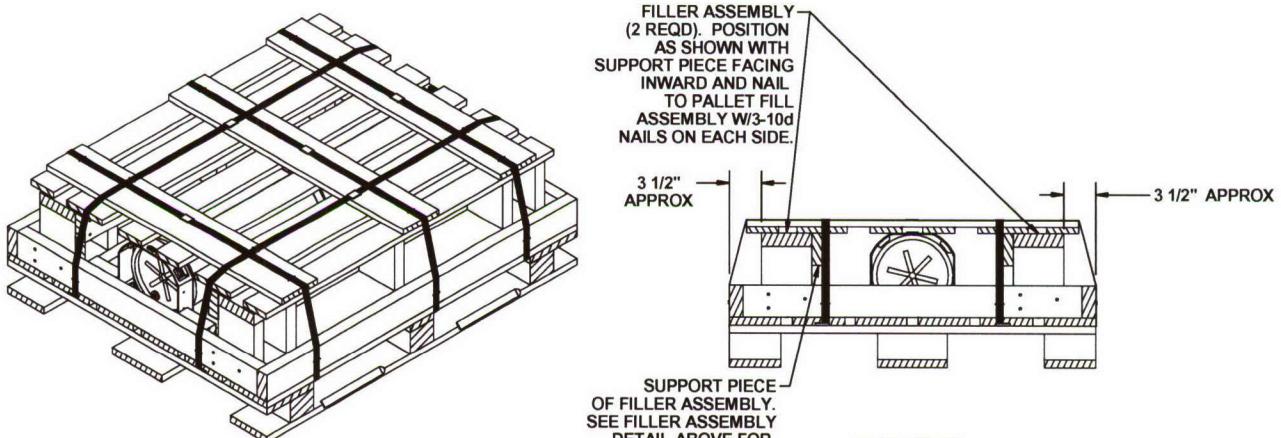
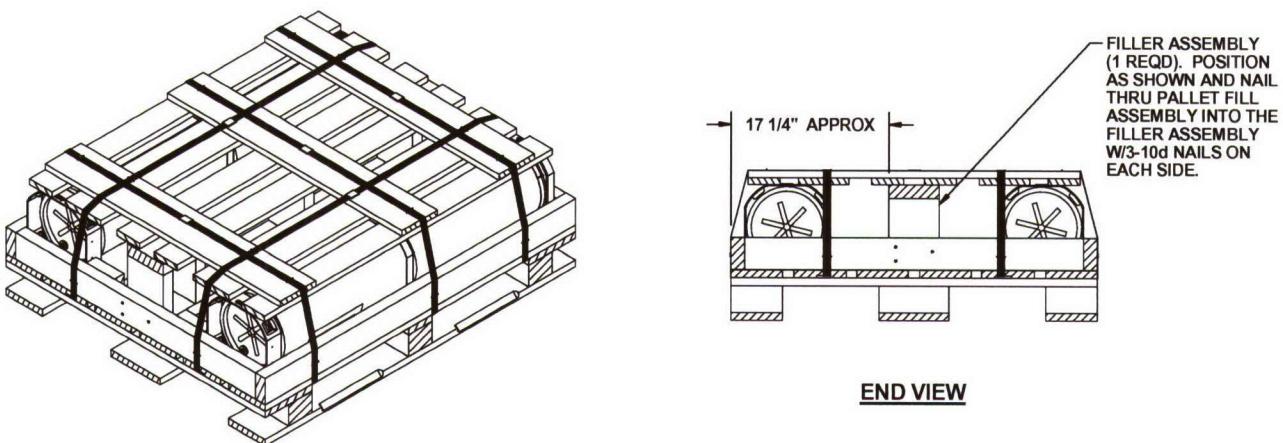


PALLET FILL ASSEMBLY



END VIEW

FILLER ASSEMBLY



FILLER ASSEMBLY
(2 REQD). POSITION AS SHOWN WITH SUPPORT PIECE FACING INWARD AND NAIL TO PALLETT FILL ASSEMBLY W/3-10d NAILS ON EACH SIDE.

3 1/2" APPROX 3 1/2" APPROX

SUPPORT PIECE OF FILLER ASSEMBLY.
SEE FILLER ASSEMBLY DETAIL ABOVE FOR NAILING GUIDANCE.